The UK Wireless Internet Service Providers Association

Consultation Response to Strategic Spectrum Roadmap Towards 5G for Europe

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Abstract — The spectrum roadmap does not pay sufficient attention to the needs of the rural communities to have access to the 3.4 to 3.8 GHz spectrum. This can be achieved without any degradation to the urban 5G service by adopting a method of sharing.

Contents

1 Introduction

May I thank the Radio Spectrum Policy Group (RSPG) for inviting comments on the Draft RSPG Second Opinion on 5G networks[1].

This document is representing the interests of Wireless Internet Service Provider (WISP)s particularly the members of UK Wireless Internet Service Provider Association (UKWISPA) and Independant Networks Cooperative Association (INCA). Both groups have been consulted on the contents of this response.

2 The European Commisions Objectives for Broadband Europe

These objectives are laid out in 'Broadband Europe'[2] where there are three main objectives stated as:

- Gigabit connectivity for all main of socio-economic drivers,
- uninterrupted 5G coverage for all urban areas and major terrestrial transport paths, and
- access to connectivity offering at least 100 Mbps for all European households.

The third objective is only likely to be achieved through the use of Fixed Wireless Access (FWA) in rural areas and therefore the encouragement of WISPs to invest in deploying wireless technologies.

The best spectrum for both 5G and FWA in rural is 3.4 to 3.8 GHz band (3.6 GHz band). Therefore there is a need for a sharing framework for this spectrum where 5G can use the spectrum in high density applications and WISPs can use it in lower density rural applications.

The challenge is to define appropriate regulations for the sharing of this spectrum. The United States of America (USA) through Citizens Band Radio Service (CBRS) has found such a method. Adapting this method for Europe could enable sharing this spectrum.

[1] Call for comments https://circabc.europa.eu/d/a/workspace/SpacesStore/fdf96fcf-16c5-4492-babd-a92eabecdef4/RSPG17-034final_2nd_draft_opinion_on_5G.pdf

[2] Broadband Europe https://ec.europa.eu/digital-single-market/en/policies/broadband-europe

3 About WISPs in the UK

Many WISPs in the UK are members of UKWISPA and/or INCA. Total WISP coverage in the UK is estimated to be 1.25 million properties (5%). The number of connected homes and business is estimated to be 225 thousand properties (nearly 1%). The economic method of connecting these properties is through the use of 5.725 to 5.85 GHz band (5.8 GHz band).

5% of UK does not have superfast broadband of which 4/5 are in rural areas. An extreme example is that 94% of farmers do not have superfast broadband. In rural areas the lowest cost method of provision of superfast broadband is through the use of FWA.

WISP businesses and their customers propects would be improved substatially through the use of lower frequency licensed spectrum where longer ranges and greater certainty would enable greater coverage and Service Level Agreements (SLAs) to be used.

WISPs are already using technologies which are at least as spectrally efficient as 5G is expected to be with peak spectral efficiencies as high as 30 bps/Hz in the downlink.

4 Primary 5G Spectrum — 3.4 to 3.8 GHz

As has been recognised by the 5G community, the 3.6 GHz band is very valuable for medium range broadband communications. The band has been recognised as a primary band for 5G.

The consultation document has not taken sufficient account of an important existing and future use of 3.6 GHz band to provide broadband to homes and businesses particularly in rural areas. This use has not yet reached a peak because the requirements of consumers are increasing and the provision of broadband in rural communities is less than satisfactory. This is demonstrated by the Ofcom Connected Nations Report 2017 in which 4% of the country does not have access to "decent" broadband of which. In a survey by the NFU[3] it is shown that in the UK 6% of farmers have superfast broadband.

Although WISPs have been providing service using 5.8 GHz band, the 3.6 GHz band is necessary to provide assured low cost service to rural communities through spectrum protection and low cost technology.

[3] NFU Survey results 2016 https://www.nfuonline.com/assets/98021

How are the two requirements to be satisfied? Sharing is the most obvious answer. Sharing can work because the 5G mobile requirement will typically be in cities and not be able to be provided in rural areas (see next section) and FWA using this band will not normally be needed or appropriate in cities but is needed in rural areas. If FWA is required in cities because fibre has not reached particular areas then a higher frequency (such as 26 GHz or 60 GHz) is preferable since that will give higher broadband speeds and the distances will be lower than in rural areas.

There are two routes for licensing,

a. one is to regulate the region to be covered by the license holder, and
b. the other is to define a mechanism where market forces will perform an optimum function so that the regulator does not have to intervene.

In a. above the regulator will need to designate the areas that are to be licensed for a particular purpose. The regulator might choose that the 5G mobile operators MNOs licenses are auctioned for urban, stations, stadia and shopping malls. The question then becomes how to license the WISPs who will be using the spectrum for FWA. Unlike MNOs they will probably not want the whole country because they tend to operate regionally.

In alternative b. a mechanism such as CBRS can be defined where there are three types of license. Incumbents, Priority and General licenses. The Incumbents would perhaps be the existing satellite and possibly the Point-to-Point (PtP) license holders. Priority would be a new class of license which would essentially guarantee interference free operation by not allowing other systems in the licensed area. General allows for innovative services which we cannot yet imagine, they would be allowed to operate at low cost but without interference protection in areas not covered by Priority or Incumbent licenses. Over a period of time the Incumbent licenses could be phased out leaving the continuation to be a Priority license.

CBRS has specifications to cover the possibility of interference to another area or frequency where the signal level at the edge of their area or frequency has to be lower than a certain signal strength.

The regulator should define the areas to be licensed and the price of a license. In the USA these are census tracts which are defined areas that contain about 4000 inhabitants, obviously this is specific to the USA. In the United Kingdom (UK) these might be one kilometer squares as defined by Ordnance Survey, where the price of a square could be defined by the number of properties in the square (Ordnance Survey have these numbers). The price needs to ensure that the purpose is warranted while ensuring that the spectrum is used.

You will note that long range PtP applications and satellite protection may have a substantial cost associated with them because of the area over which a license

would be required to ensure interference free operation. The granting of Incumbent licenses for a period enables such operation to adjust to the requirement.

As far as an optimum size is concerned each administration will have to define an appropriate mechanism for their territory. Too small and the administrative burden on Member States can be large, if the size is too large then the market forces may not be able to operate appropriately.

4.1 Will MNOs deploy at 3.6 GHz in rural areas?

In most countries LTE has not been deployed extensively in rural areas using 1800 MHz. Propagation in 3.6 GHz is significantly more difficult particularly in rural areas where the distances between base stations is greater and the density of trees is higher than in urban areas. These facts cause the signal to be required to travel through trees for significant distances. If the allocated loss through trees at 1800 MHz is x dB, then the loss at 3600 MHz will be $3x$ dB.

Considering the differences between 1800 MHz LTE and 3.6 GHz 5G we observe the following changes;

Item	**Value**
Extra Free Space Path loss	6 dB
Extra Diffraction loss (assume all losses are foliage)	0 dB
Extra Foliage loss (10 dB to 30 dB)	20 dB
Extra wall penetration loss	5 dB
Extra bandwidth loss (20 MHz to 80 MHz bandwidth)	6 dB
Total losses	**37 dB**
UE antenna gain	6 dB
Beamforming gain at base site	3 dB
Total gains	**9 dB**
Grand total losses	**28 dB**

Table 1 Change from 1800 MHz LTE to 3600 MHz 5G for Rural areas

Table 1 shows the gains and losses going from 1800 to 3600 MHz. 28 dB extra losses is severe and will mean that cell sizes are much smaller at 3600 MHz. The smaller

cell size will cause the extra cost to be prohibitive. The MNOs will have to use lower frequencies and lower bandwidths for their 5G deployments.

4.2 Will WISPs deploy at 3.6 GHz in rural areas?

Reducing the frequency from the 5.8 GHz band to 3.6 GHz band improves the penetration of the signal to properties at longer ranges by reducing the loss through foliage and by having a higher e.i.r.p. available. The developed market in products in 3.6 GHz band will enable deployment to occur almost immediately after the spectrum is available. Also the availability of technology from 5G will enable lower cost, higher capacity and longer ranges to be obtained. The fundamental difference between Fifth Generation Mobile System (5G) and FWA is the methods of deployment. FWA only requires a single point to be serviced on a property, whereas, 5G mobile requires coverage around and inside the property.

Item	**Value**
Extra transmit power	6 dB
Lower Free Space Path loss	4 dB
Lower Diffraction loss (assume all losses are foliage)	0 dB
Lower Foliage loss (30 dB to 12 dB)	18 dB
No wall penetration loss	0 dB
No bandwidth Change	0 dB
Total gains	**28 dB**
UE antenna loss	4 dB
Total losses	**4 dB**
Grand total gains	**24 dB**

Table 2 Change from 5800 MHz LTE to 3600 MHz FWA for Rural areas

Table 2 demonstrates how much more effective FWA can be in this band than in the band that the WISPs have to use. 24 dB can be used to either deliver greater throughput or to deliver much larger cells (potentially by as much as a factor of 10).

5 Detailed comments on the Opinions expressed

Opinion 1

UKWISPA and INCA welcomes and endorses the opinion that Member States will need flexibility as described. The 3.6 GHz band is particularly suitable for WISPs to help further the digital agenda by providing broadband access in rural areas. This spectrum is available licensed in some countries but not in others and so in the case of the countries which do not have access to this spectrum the WISPs typically do not have any protected spectrum to use for the delivery of FWA and so are unable to provide SLAs to their customers. The typical spectrum available for long distance broadband delivery is either 5.8 GHz band or 700 MHz (WhiteSpace) band (700 MHz). The 5.8 GHz band is typically unprotected and WhiteSpace services has insufficient spectrum available for superfast delivery.

Opinion 2

5G related policy objectives in rural areas may not be sufficiently succinct. Rural citizens who do not have superfast broadband are looking for solutions in the near future where superfast broadband availability is more important than intermittent high speed mobile availability. The transition from untethered communications using home broadband to full mobile communications should be seamless. This would enable greater coverage and satisfaction from the users. The opinion suggests that satellite alone can provide the rural broadband objective. We think that there are 3 technologies of interest in rural areas. Fibre to the premises (FTTP) for the higher property density, FWA for medium property density and satellite for low property density. The density at which these transitions occur have ranges and the ranges will change over time as FTTP increases in density.

Opinion 3

studying solutions for improving 5G connectivity and wide area coverage are important objectives and the WISP industry would see this being achieved by FWA and home microcells able to attach to any network and provide the transition from inside to outside in a seamless manner.

Opinion 4

Agreed

Opinion 5

Agreed

Opinion 6

Agreed

Opinion 7

The trading of valuable spectrum is very important and possibly the rules adopted in USA CBRS provide an insight into how this can be achieved effectively.

Opinion 8

In addition to defragmenting the spectrum early access to the spectrum could be achieved by using the three category methods available in CBRS to enable a smooth transition from the use made by incumbents in areas and the use to be made by mobile and fixed access.

Opinion 9

UKWISPA and INCA have no concise opinion today on the regulations for the pioneer bands.

Opinion 10

UKWISPA and INCA agree that the 5 GHz bands in many countries have had general authorisation and have as a consequence enabled innovative use of the spectrum. Advances that have occurred include;

- Making use of cognitive radio techniques to enable automated frequency choices based upon the signals detected in an area.
- Invention of Time Division Duplex (TDD) synchronisation technologies such as Global Positioning System (GPS) and 1588 to enable more efficient use of spectrum before the advent of standardised TDD Long Term Evolution of Mobile Networks (LTE).
- Delivery of efficient high speed broadband service to rural areas where fibre or high speed copper delivery is too expensive.

these higher frequencies can be important for backhaul of mobile and fixed networks, however the usefulness fundamentally depends upon the licensing costs.

6 Other Points

Page 3 Introduction first bullet

Should be qualified “in urban, stations, shopping malls and stadia where large populations congregate.”

Page 7 A.1 paragraph 8

The 3.6 GHz band use case should be qualified "in urban, stations, shopping malls and stadia where large populations congregate."

Page 9 A2.1.2 Second bullet

Modify to "The antenna beam forming technologies (where safety limits are not exceeded) being developed for 5G will be used to improve link quality, increasing sector capacity and throughput to individual end users."

Page 10 A2.1.3 First bullet

Consideration should be given to the use of the techniques used in CBRS to improve the likelihood of spectrum sharing.

Page 13 A2.2 Second Bullet

The use of higher frequency bands (3.6 GHz band and above), enabling new services and applications is likely to require different approaches to authorisation, to respond to the diverse set of new market players in addition to the existing network operators.

Page 14 A2.4.1 First bullet

Mobile connectivity and fixed broadband are becoming a necessity . . .

Page 15 A2.4.1 Second bullet

Beginning 'A coverage . . . '. Coverage obligations often are not enforceable. The CBRS method does not enforce coverage but rather ensures that coverage can be achieved for some service if the MNOs do not offer service and the administration is prepared to subsidise an area.

Page 17 A2.4.2 Sixth bullet

The problem of rural provision of broadband and mobile services needs to be expanded. FWA can provide coverage of broadband services in a cost efficient manner. It also is demonstrating spectral efficiencies well above those currently available from the mobile industry despite the technology being available to mobile suppliers. Perhaps the answer here is that 5G should be aiming to provide coverage using broadband infrastructure to provide the backhaul so that farms can put up their own low power mobile base site where they need them.

Page 17 A2.4.2 Seventh bullet

Satellite is not usually the answer because it will always be more expensive than terrestrial solutions to broadband for large quantities of data. There will always be occasions in very sparcely populated locations where satellite will be the right solution.

7 List of Abbreviations

CBRS	Citizens Band Radio Service
5.8 GHz band	5.725 to 5.85 GHz band
5G	Fifth Generation Mobile System
FTTP	Fibre to the premises
FWA	Fixed Wireless Access
GPS	Global Positioning System
INCA	Independant Networks Cooperative Association
LTE	Long Term Evolution of Mobile Networks
MNOs	Mobile Network Operators
PtP	Point-to-Point
RSPG	Radio Spectrum Policy Group
SLAs	Service Level Agreements
TDD	Time Division Duplex
3.6 GHz band	3.4 to 3.8 GHz band
UK	United Kingdom
UKWISPA	UK Wireless Internet Service Provider Association
USA	United States of America
WhiteSpace	700 MHz
WISP	Wireless Internet Service Provider
WISPs	Wireless Internet Service Providers